



# **FRIESE corrugating rolls**

**Outside hard**

**Inside smart**





# FRIESE

Our company was founded in 1992 and

- employs 70 qualified people, including many graduate engineers.
- has an installed production capacity for 500 sets per year.
- is represented by partners or sales agents in all continents.
- is certified according to ISO 9001: 2015 and AEO.

This assures our customers that we manufacture products and services of consistently good quality.

## FRIESE-developments:

*1995 CCS I and THERMOGROOVES*

*1996 ROCKWELLE tungsten carbide coating*

*1998 Profile optimization ROCKPROFILE*

*1999 CCS II*

*2001 ROCKWELLE improved coatings, sprayed in-house*

*2005 ROCKWELLE coating as smooth as chrome*

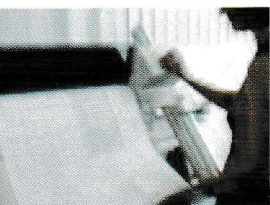
*2006 Rolls for cold corrugating single facers*

*2009 Totally welded peripherally heated big size rolls*

*2011 Steam joints for peripheral heated rolls*

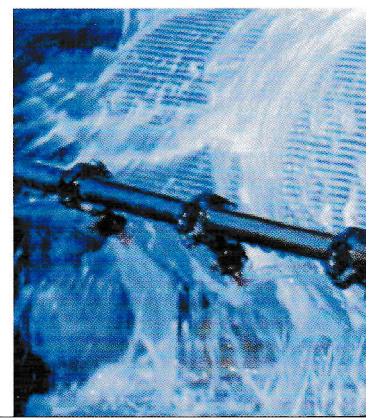
*2015 5th Waldrich grinder for 500 set capacity*

*2017 deep hole drilling equipment to complete process in house*



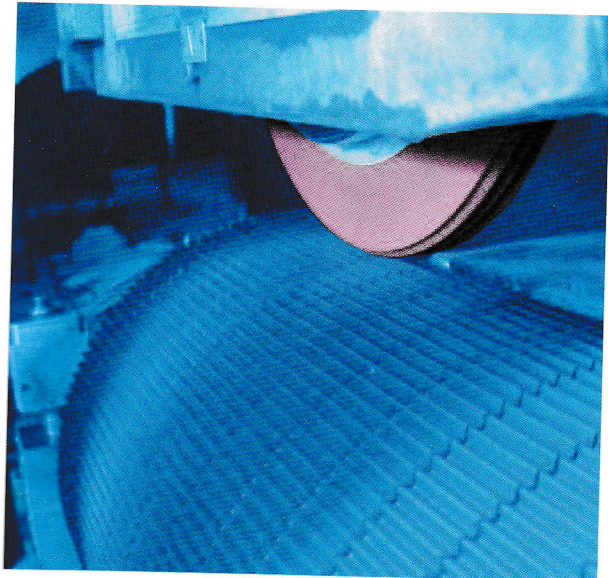
FRIESE stands for innovation, quality and reliability regarding the production from corrugating rolls at all our partners and our customers. We are held in great esteem worldwide in this respect.

The research and design engineers from Frieze have one thing in mind when finding technological solutions and that is to meet customer requirements. Better running rolls which reduce productions costs and produce better quality corrugated board are amongst the advantages which Frieze customers appreciate today. In order to ensure that customers continue to benefit, Frieze attaches the greatest importance to highest precision, using high-quality materials, latest manufacturing processes and strict quality controls. This along with continuous further developments guarantees that working with Frieze rolls is definitely worth your while.

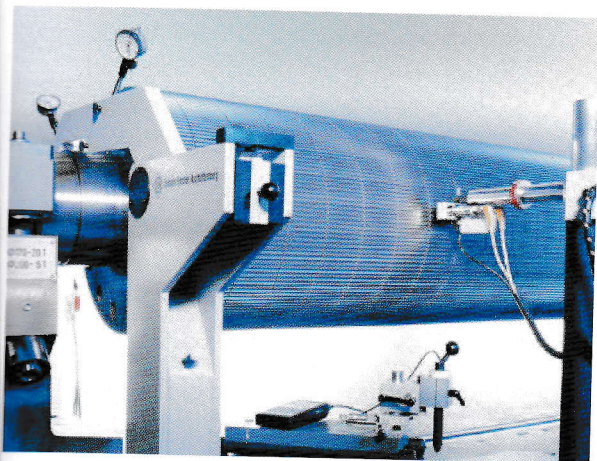




# corrugating rolls



*Corrugating roll grinding machine*



*Roll measuring station*



*Induction hardening*

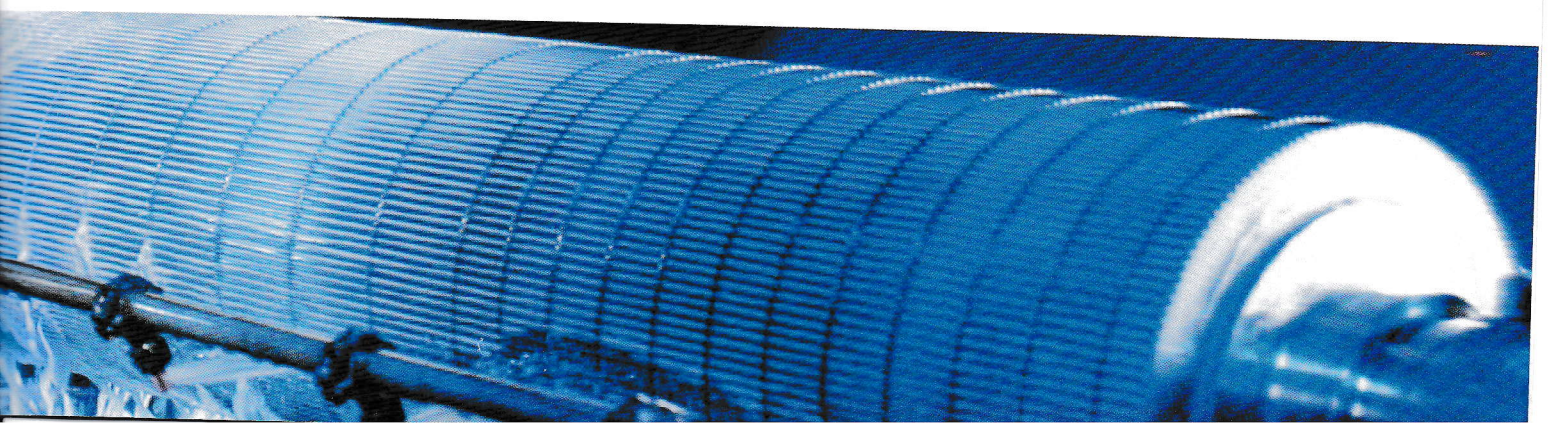
FRIESE manufactures new corrugating rolls for all types of single facer and refurbishes worn rolls, using a fully integrated manufacturing procedure. That means the complete corrugating roll production – starting from the forged steel bars through to the application and special polishing of the tungsten carbide coating – is done at our workshop.

For the hardening procedure we use induction hardening as well as nitriding.

FRIESE corrugating rolls are ground on the most modern grinding machines available. Due to the high precision of our CNC corrugating roll grinding machines the roundness tolerance is 20 microns.

In addition to corrugating rolls we produce press rolls, glue rolls, rotary joints and cartridges. Furthermore we do single facer conversions from finger to vacuum system.

In support of our customers we offer a range of services like roll installations, check-up measurements and all kind of specialized analysis work concerning the good performance of the rolls and single facers.





# ROCKWELLE

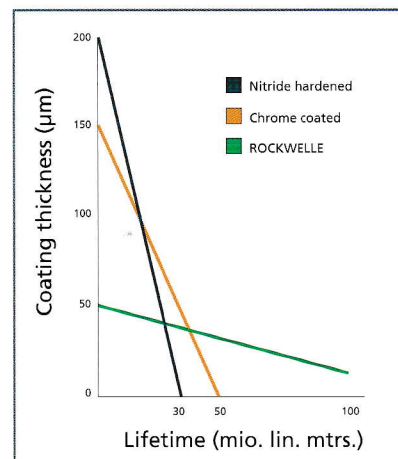
Our main product is the corrugating roll. In 1996 FRIESE introduced in Europe corrugating rolls coated with a special coating of tungsten carbide, which we call ROCKWELLE. Nowadays different coating qualities and surface smoothness are offered under "tungsten carbide coating". But their spraying technique, coating composition and quality assurance measures are very different. Our ROCKWELLE-coatings, sprayed by HVOF-process, are known for their excellent adhesion and wear resistance.

Furthermore, we have also developed *SHINEROCKWELLE*, which is a result of combining a special coating material with a multi-step polishing technique that guarantees a surface smoothness comparable to chrome-coating (roughness  $R_a < 0,1$  microns).

The advantages to our customers through the smoother surface of *SHINEROCKWELLE* (as smooth as chrome) are significant:

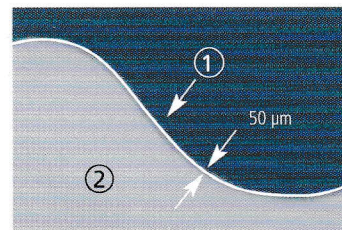
- Maximum speed right at production start up
- Higher board strengths due to less tension in the fluting medium
- Longer roll life due to cleaner roll surface

The graph shows coating thickness and life time of different roll surfaces. Compared to nitride hardened and chrome plated rolls the ROCKWELLE shows a much longer lifetime. In addition nearly no wear is noticeable on the flute tips.



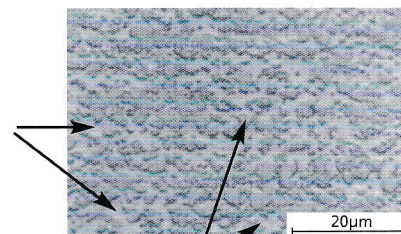
## ROCKWELLE-corrugating roll

1. ROCKWELLE-coating
2. Basic roll material



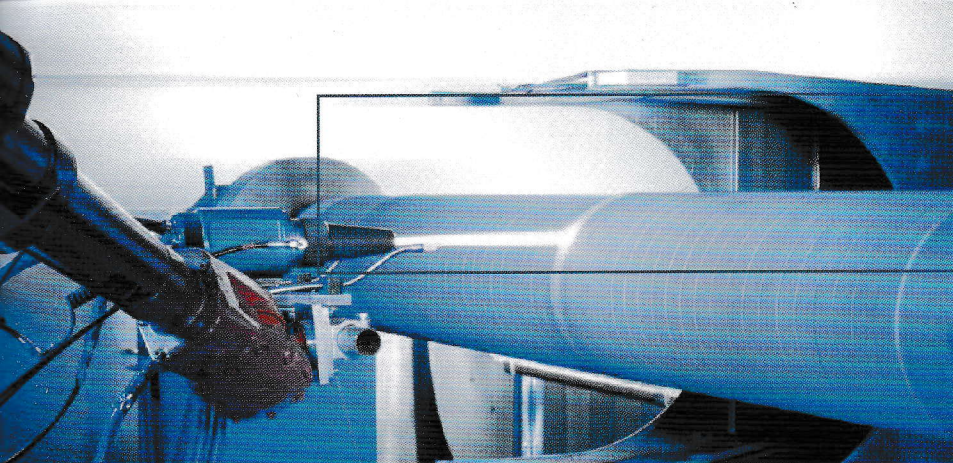
## ROCKWELLE-microstructure

cobalt-matrix



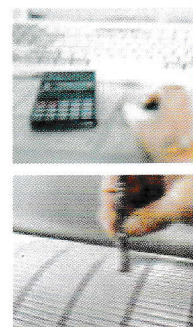
tungsten-carbide particles





*Spraying of the Rockwelle-coating*

The fact that the flute profile coated with ROCKWELLE remains almost constant during long roll lifetime enables us to optimize the flute profiles significantly. Our ROCKPROFILES are the result.



#### The optimized ROCKPROFILE

The starting point for profile optimization is to keep the web tension of the fluting paper in the labyrinth between the corrugating rolls at a minimum. This way, better corrugating board quality and roll runnability are reached.

The ROCKPROFILE is designed individually for each application. Different parameters – for example, type of single facer, paper grades, production speeds – have to be considered. The take-up factor can be reduced significantly while the same or even higher corrugating board strength is achieved.

$$T = T_0 \cdot e^{\mu \vartheta}$$

$T$  = web tension in labyrinth

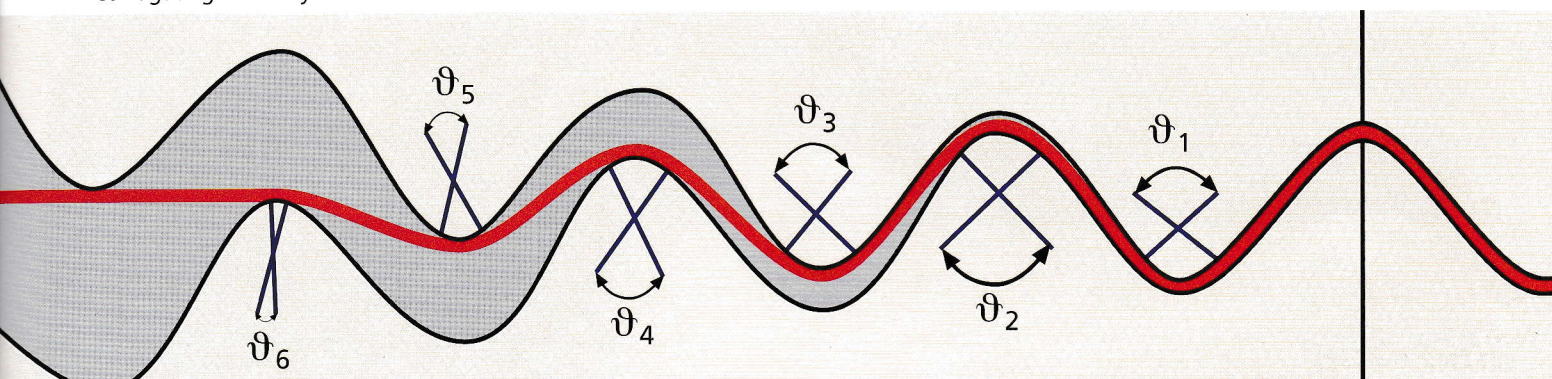
$T_0$  = web tension at roll-stand

$\mu$  = coefficient of friction of roll surface

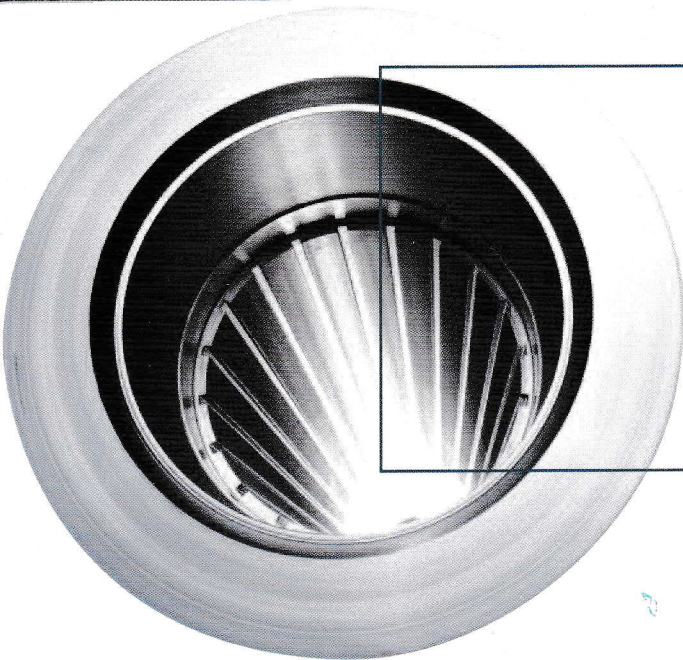
$\vartheta$  = sum of wrap angles in labyrinth

	Take-up factor conv. profile	Take-up factor ROCKPROFILE
C-flute	1,42	1,34 - 1,38
B-flute	1,31	1,27 - 1,30
E-flute	1,24	1,18 - 1,21

*Corrugating rolls labyrinth*





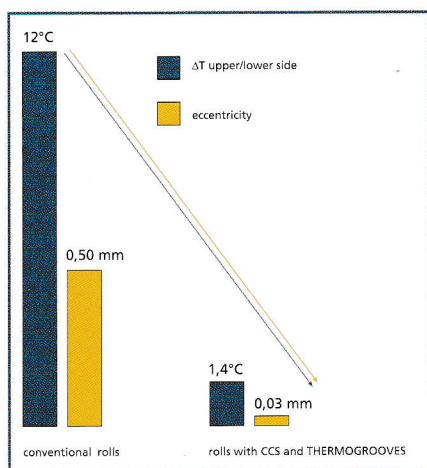


# Controlled Condensate System (CCS) and Thermogrooves

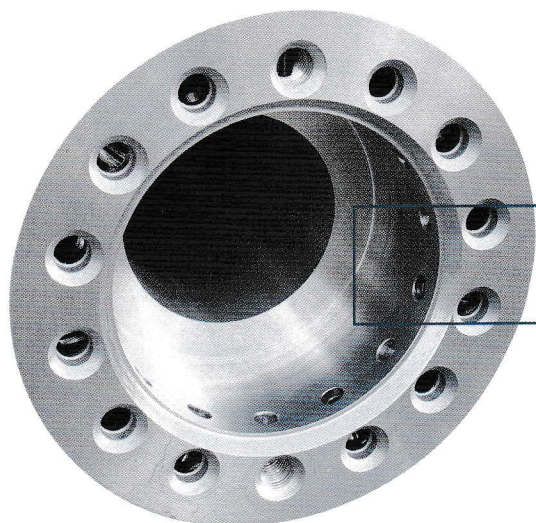
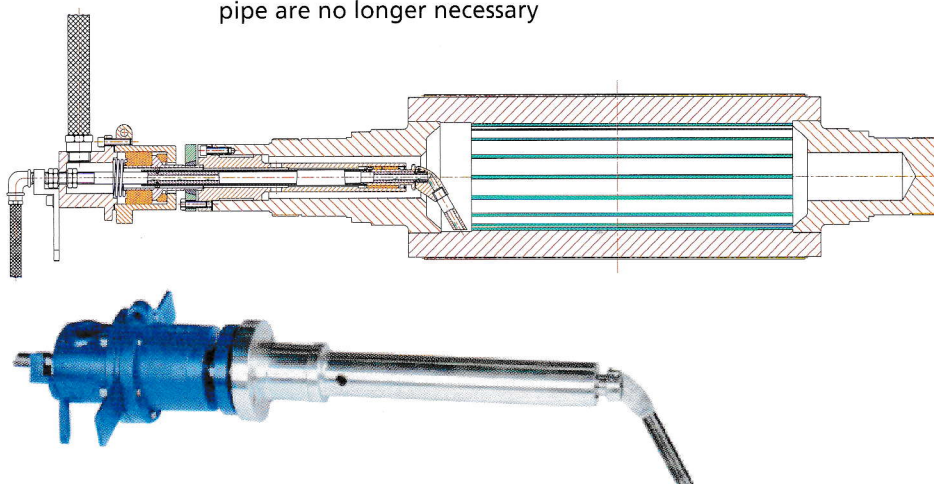
Our product, CCS, combined with THERMOGROOVES avoids the build-up of an insulating film of condensate inside the rolls during operation. As a result there is nearly no roll warping during stops.

## Advantages of CCS / THERMOGROOVES

- better heat transfer which enables higher production speeds and better gluing
- less waste at production re-start through minimized 'banana effect'
- less maintenance since readjustments of condensate pipe are no longer necessary



**Warping during stops**  
Analysis by the University of Coburg (preheating to 180° C, measurements 30 min. after stop)

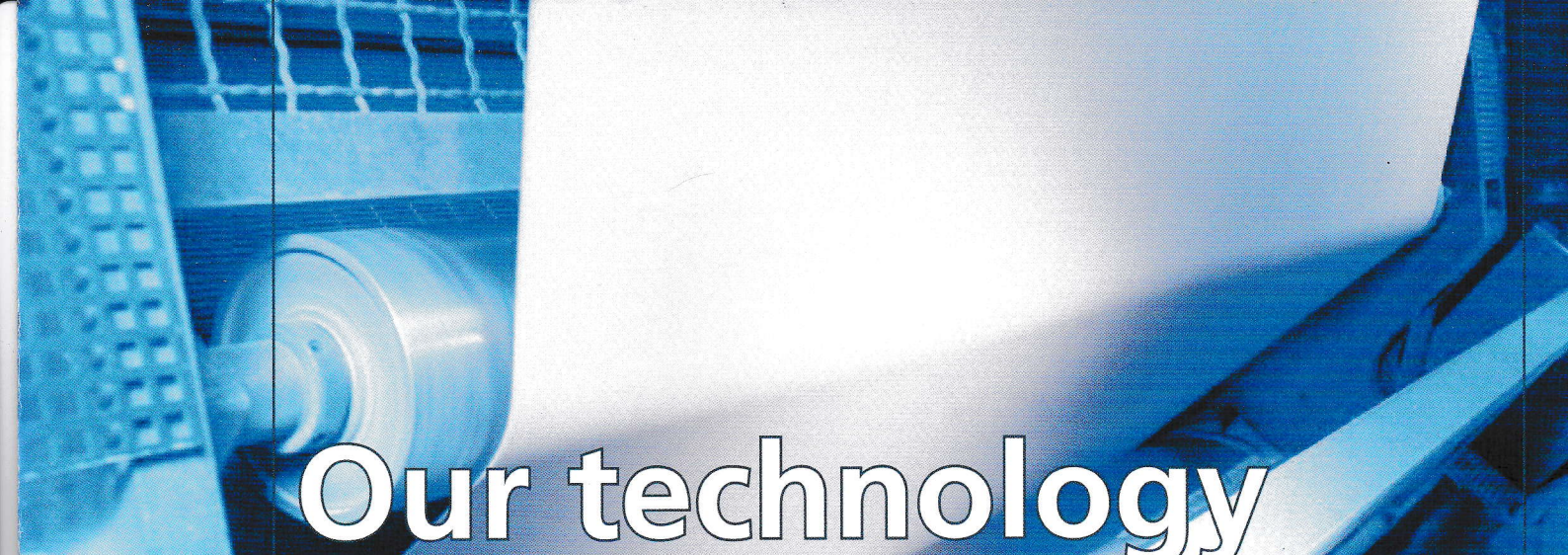


## Peripheral heated rolls

Needing shorter times for heating up, peripheral heated rolls allow faster flute changes in single facers with cassettes. They also share many of the advantages of rolls with CCS and Thermogrooves.

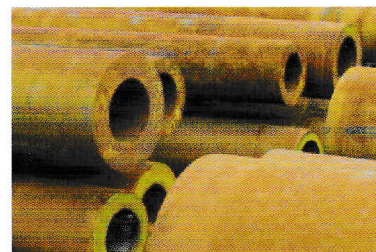






# Our technology Your advantage

- longer roll lifetime
- higher profile stability
- 2-5 % less paper consumption
- up to 5 % increased corrugating board strength
- constant production conditions on high level:
  - no 'running in' of rolls after installation
  - higher production speed
  - constant glue application
  - reduced vibrations
- lower service and maintenance costs:
  - no regrinding of roll edges necessary
  - no maintenance and readjustments is required at CCS



A corrugating board plant using FRIESE rolls with ROCKWELLE, ROCKPROFILE and CCS/ THERMOGROOVES can realise

**Savings over 100.000 Euro/year**

at a production of 100 mio. m<sup>2</sup>/year - compared to using conventional tungsten carbide coated corrugating rolls.





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